# Premilitary MMPI Scores as Predictors of Combat-Related PTSD Symptoms

Paula P. Schnurr, Ph.D., Matthew J. Friedman, M.D., Ph.D., and Stanley D. Rosenberg, Ph.D.

*Objective:* *The authors used data collected before military service to assess predictors of combat-related lifetime symptoms of posttraumatic stress disorder (PTSD).* *Method:* *The subjects were 131 male Vietnam and Vietnam-era veterans who had taken the MMPI in college and who were interviewed as adults with the Structured Clinical Interview for DSM-III-R. Scores on the basic MMPI scales were used to predict combat exposure, lifetime history of any PTSD symptoms given exposure, and lifetime PTSD classification (symptoms only, subthreshold PTSD, or full PTSD).* *Results:* *Group means on the MMPI scales were within the normal range. No scale predicted combat exposure. Hypochondriasis, psychopathic deviate, masculinity-femininity, and paranoia scales predicted PTSD symptoms. Depression, hypomania, and social introversion predicted diagnostic classification among subjects with PTSD symptoms. The effects persisted when amount of combat exposure was controlled for.* *Conclusions:* *Premilitary personality can affect vulnerability to lifetime PTSD symptoms in men exposed to combat.*

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Little is known about the role of predisposing variables in the development of combat-related posttraumatic stress disorder (PTSD). Some studies have indicated that PTSD is associated with combat exposure but not with factors predating the exposure (1–3). Others have suggested that premilitary variables predict combat-related PTSD, even when amount of exposure is controlled for (4–6). Pretrauma variables also predict PTSD following noncombat trauma (7). In both combat and noncombat subjects, risk is higher in those with childhood socioeconomic deprivation, prior psychiatric or behavioral problems, lower educational attainment, early separation, or family history of psychiatric disorder.

Unfortunately, most studies of predisposition to PTSD have used case-control designs with retrospective measures of premilitary variables. Some investigators have avoided retrospective measurement by using archival sources of premilitary information (1, 2, 6), but to our knowledge no one has examined premilitary measures of standardized psychological variables in subjects with clinically based diagnoses of PTSD. We report on one such study that was made possible by the existence of college MMPI scores for the Dartmouth College classes of 1967 and 1968. The MMPI (8) is a valuable tool for assessing combat-related PTSD (5, 9). The study is distinctive because we have a widely accepted measure of personality for combat veterans that is uncontaminated by biases due to memory failure, retrospective distortion, or current state. The study also is distinctive because this socioeconomically select group of subjects is expected to be reasonably well protected from factors that increase risk of PTSD.

On the basis of reports of preexisting psychiatric and behavioral problems as risk factors for PTSD (4, 5, 7), we hypothesized that high premilitary MMPI scores would increase the likelihood of PTSD, even after combat exposure was controlled for.

## METHOD

The all-male, predominantly Caucasian (>98%), Dartmouth College classes of 1967 and 1968 took the MMPI as freshmen in 1963 and 1964. Between 1985 and 1987 we sent a military history questionnaire and MMPI to all 1,483 surviving members, and 739 (50%) responded. The respondents were highly similar to the nonrespondents in college MMPI scores (10).

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Almost 52% of the 712 respondents with usable data were civilians during the Vietnam War, 28% were noncombat veterans, 17% were combat veterans, and 3% refused induction or were conscientious objectors. We selected subjects from the veterans, excluding those who were in combat outside the Vietnam theater or who were noncombatants in Vietnam. We intended to select 80 combat veterans and 40 noncombat Vietnam-era veterans by randomly sampling within the groups separately. After 10% of the subjects had been randomly chosen, financial considerations forced us to switch to selecting a combat veteran and finding noncombatants who lived near him. This process was guided by the geographic distribution of our combat veterans.

The interviewed subjects were representative of all respondents in current demographic characteristics ($p>0.10$ in all cases). They did not differ from the nonrespondents or the other respondents on college MMPI scores ($p>0.10$ in all cases) or from the other respondents on other college data or military background ($p>0.10$ in all cases), except for variables that reflected our oversampling of combat veterans (e.g., combat exposure).

The interviews included selected modules of the Structured Clinical Interview for DSM-III-R (SCID) (11), from which we created three measures of lifetime diagnosis: affective disorder, chemical use disorder (alcohol or substance abuse/dependence), and PTSD (to be explained). There were too few current diagnoses in the first two categories to be analyzed, and so only data on current PTSD are presented.

All except seven interviews were conducted in person, usually at the subject's home or workplace. Most interviews (and all but one of those with combat veterans) were conducted by a senior clinician, a 4th-year psychiatric resident, or a master's-level social worker with extensive SCID experience. Others were conducted by a clinical psychology Ph.D. intern (N=4) or a bachelor's-level research assistant with extensive research interview experience (N=8).

The interviews were audiotaped, and a subset of 43, including six cases of full lifetime PTSD and six cases rated by the original interviewer as subthreshold lifetime PTSD, were used to assess interrater reliability. For diagnoses that occurred frequently enough to allow meaningful calculation of a kappa, agreement was excellent: lifetime major depression, kappa=0.99; lifetime alcohol use, kappa=0.88; lifetime PTSD, 100% agreement; and current PTSD, kappa=0.93.

On the basis of the SCID and questionnaire data, the subjects were classified as noncombat Vietnam-era veterans (N=39), combat comparison subjects (N=59), or combat veterans with any lifetime PTSD symptoms (N=38). Ten of the men in the group with PTSD symptoms had full lifetime PTSD. Fourteen were considered to have subthreshold PTSD, defined as meeting DSM-III-R criterion A (stressor) and criterion E (duration) plus one of the following: 1) meeting criterion B (reexperiencing) and criterion D (hyperarousal) but not criterion C (numbing/avoidance); 2) meeting criterion B and having at least one C symptom and one D symptom; or 3) having the sufficient number of criteria B, C, and D symptoms but with some or all rated as subthreshold. The other 14 men did not meet the criteria for subthreshold PTSD but met criteria A and E and had two or more lifetime PTSD symptoms, one of which was specifically related to criterion A (either any B symptom or one of the C avoidance symptoms).

After selection of subjects with fewer than 35 missing MMPI items, the cell sizes were as follows: noncombat Vietnam-era veterans, N=38; combat comparison subjects, N=56; combat veterans with PTSD symptoms only, N=13; combat veterans with subthreshold PTSD, N=14; and combat veterans with full PTSD, N=10.

The Mississippi Scale for Combat-Related Posttraumatic Stress Disorder (12) and a combat exposure scale (1, pp. 178–179) were administered by mail to the military veterans who reported combat exposure in the questionnaire study (10). The combat scale ranged from 0 (no exposure) to 36 (maximal exposure). Both the Mississippi and combat scales had high internal consistency (alpha=0.87 and 0.88, respectively). The questionnaire data were used to characterize type of service entry (drafted versus enlisted) and branch of service (Army/Marines versus other); the latter was used to contrast the branches that have the greatest risk of PTSD (5) with all others.

The data analyses were modeled after those of Breslau et al. (7) and focused on four nested orthogonal contrasts to predict 1) combat exposure, 2) any lifetime PTSD symptoms (symptoms only, subthreshold PTSD, or full PTSD) given combat exposure, 3) a full or subthreshold lifetime PTSD diagnosis given any lifetime PTSD symptoms, and 4) full versus subthreshold lifetime PTSD. We performed these contrasts for lifetime diagnoses only because there were few current cases of full (N=4) or subthreshold (N=7) PTSD.

For each contrast, we performed t tests of the 13 basic MMPI scales. If at least one test result was statistically significant, we submitted all scales as predictors in stepwise logistic regression, using forward selection to determine the unique effect of each variable. We performed these regressions both with and without control for scores on the combat exposure scale (1).

We used t tests for univariate screening because our predictors were continuous and effects could be presented most simply as d, the proportion of a standard deviation by which groups differ (13). Effect sizes are an ideal way to compare differences across variables, study groups, and even experiments. They facilitated comparisons among our four contrasts, which varied markedly in group size.

We used logistic regression because it requires fewer assumptions than discriminant analysis or MANOVA. In logistic regression, statistically significant predictors are those for which the confidence interval about an odds ratio does not include 1.0. The odds ratio for a continuous variable, such as an MMPI score, reflects a change in the odds of belonging to the predicted group that is associated with an increase of one unit in a predictor; ours were calculated to reflect an increase of one standard deviation to facilitate comparison between variables. For example, an odds ratio of 2.0 would indicate that an increase of one standard deviation doubled the odds of belonging to the predicted group.

For categorical variables, descriptive analyses were performed with chi-square tests and examination of standardized residuals, and for continuous variables, ANOVA and Tukey tests were used.

The criterion for statistical significance was $p<0.05$ (two-tailed for bidirectional tests).

## RESULTS

### *Descriptive Analyses*

The groups were similar in demographic status (table 1). They differed significantly in type of service entry, owing mostly to the greater likelihood of being drafted in those with subthreshold PTSD. The groups also differed in branch of service, primarily because the likelihood of having served in the Army or Marines was higher in the subthreshold group and lower in the Vietnam-era veterans. The combat veterans differed significantly in amount of exposure. The subthreshold PTSD and symptoms-only groups reported more exposure than did the combat comparison subjects, whereas the full-PTSD group did not differ significantly from the other groups.

The groups differed significantly in lifetime history of affective disorder, primarily because of the greater likelihood of affective disorder in the men with full PTSD (table 1). The significant difference in chemical use was due to the greater likelihood of disorder in both the subthreshold-PTSD and full-PTSD groups. The groups exposed to combat differed significantly on the Mississippi scale. The full-PTSD group had a higher score than did the combat comparison subjects or the symptoms-only group.

According to our rules for categorizing lifetime PTSD, over half (N=20) of those with lifetime PTSD symptoms had current PTSD symptoms. Of the men with full lifetime PTSD, four currently met the full di-

**TABLE 1. Characteristics of Vietnam-Era and Vietnam Combat Veterans With and Without PTSD**

| Variable | Noncombat Vietnam-Era Veterans (N=38)[a] | Combat Comparison Subjects (N=56)[a] | Combat Veterans With PTSD Symptoms | | | Statistical Test |
|---|---|---|---|---|---|---|
| | | | Symptoms Only (N=13)[a] | Subthreshold PTSD (N=14)[a] | Full PTSD (N=10)[a] | |
| Demographic status | | | | | | |
| Age at time of study (years) | | | | | | F=1.34, df=4, 126, n.s. |
| Mean | 40.0 | 40.0 | 40.2 | 38.8 | 39.2 | |
| SD | 2.1 | 2.1 | 2.3 | 2.0 | 1.9 | |
| Married | | | | | | $\chi^2$=7.32, df=4, n.s. |
| Number | 33 | 50 | 12 | 12 | 6 | |
| Percent | 86.8 | 89.3 | 92.3 | 92.3 | 60.0 | |
| Executive/professional | | | | | | $\chi^2$=4.12, df=4, n.s. |
| Number | 27 | 40 | 8 | 6 | 7 | |
| Percent | 73.0 | 72.7 | 61.5 | 46.2 | 70.0 | |
| Military service | | | | | | |
| Drafted | | | | | | $\chi^2$=11.86, df=4, p<0.05 |
| Number | 4 | 5 | 2 | 6 | 2 | |
| Percent | 11.1 | 9.3 | 15.4 | 46.2 | 20.2 | |
| Army/Marines | | | | | | $\chi^2$=16.63, df=4, p<0.01 |
| Number | 12 | 29 | 9 | 12 | 8 | |
| Percent | 34.2 | 51.8 | 69.2 | 85.7 | 80.0 | |
| Combat Exposure Scale score | | | | | | F=10.35, df=3, 87, p<0.001 |
| Mean | — | 6.2 | 12.3 | 15.0 | 10.6 | |
| SD | — | 4.8 | 9.9 | 6.1 | 5.1 | |
| Lifetime psychiatric history | | | | | | |
| Affective disorder | | | | | | $\chi^2$=10.95, df=4, p<0.05 |
| Number | 6 | 6 | 2 | 1 | 5 | |
| Percent | 15.8 | 10.7 | 15.4 | 7.1 | 50.0 | |
| Chemical use disorder | | | | | | $\chi^2$=21.30, df=4, p<0.001 |
| Number | 7 | 14 | 2 | 8 | 8 | |
| Percent | 18.4 | 25.0 | 15.4 | 57.1 | 80.0 | |
| Mississippi PTSD scale score | | | | | | F=4.57, df=3, 86, p<0.01 |
| Mean | — | 61.0 | 61.7 | 67.1 | 76.1 | |
| SD | — | 11.1 | 11.6 | 13.2 | 16.0 | |

[a]In a few cases, data were not available for all subjects.

agnostic criteria, four had subthreshold PTSD, and two had symptoms only. Of the men with subthreshold lifetime PTSD, three currently had subthreshold PTSD and five had symptoms only. Two men in the group with lifetime symptoms only had current symptoms.

Premilitary MMPI data for each group are presented in table 2. The group means were within the normal range (less than 70); the scores on the masculinity-femininity scale are consistent with the educational and socioeconomic background of the group.

*Prediction Analyses*

We did not perform multivariate analysis to predict combat exposure because there were no significant differences between the Vietnam-era and combat veterans on any of the MMPI scales (largest t=1.69, df=129, p=0.09, for psychasthenia). The effect sizes for the comparisons of these two groups were small (13), ranging in absolute value from 0.01 to 0.32 and averaging 0.13 (table 3).

Among the combat veterans, those with any lifetime PTSD symptoms had higher scores than the combat comparison subjects on the scales for hypochondriasis (t=2.02, df=91, p<0.05), psychopathic deviate (t=2.77, df=91, p<0.01), masculinity-femininity (t=2.26, df=91, p<0.05), and paranoia (t=2.41, df=91, p<0.05). Table 3 shows that the effect sizes for these variables were moderate (13); the no-PTSD and PTSD-symptom groups differed by approximately one-half of one standard deviation.

Only two scales entered the stepwise logistic regression to predict PTSD symptoms: first, psychopathic deviate, followed by masculinity-femininity. The adjusted odds ratios (and 95% confidence intervals) were 1.96 (1.13–3.31) and 1.71 (1.04–2.79), respectively. Together, these variables yielded a model that fit the data reasonably well (goodness-of-fit $\chi^2$=94.1, df=90, p=0.35), correctly classifying 73.1% of the cases with moderate sensitivity (56.8%) and high specificity (84.0%); 60.2% correct would be expected by chance.

When we added combat exposure scores to the model, accuracy and sensitivity increased to 76.9% and 66.7%, and specificity (83.6%) changed little (goodness-of-fit $\chi^2$=72.6, df=87, p=0.87; the degrees of freedom reflect missing data on combat exposure). The combat-adjusted odds ratios (and 95% confidence intervals) for psychopathic deviate and masculinity-femininity were 2.15 (1.09–4.23) and 2.71 (1.44–4.23), respectively. The adjusted odds ratio (and 95% confidence interval) for combat exposure was 4.45 (2.15–9.19). By itself, amount of combat exposure also pre-

**TABLE 2. Premilitary MMPI Scores of Vietnam-Era and Vietnam Combat Veterans With and Without PTSD**

| | T Score (K-corrected) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Noncombat Vietnam-Era Veterans (N=38) | | Combat Comparison Subjects (N=56) | | Combat Veterans With PTSD Symptoms | | | | | |
| | | | | | Symptoms Only (N=13) | | Subthreshold PTSD (N=14) | | Full PTSD (N=10) | |
| MMPI Scale | Mean | SD | Mean | SD | Mean | SD | Mean | SD | Mean | SD |
| Lie | 45.2 | 5.2 | 45.2 | 6.3 | 45.9 | 6.1 | 45.6 | 4.1 | 47.6 | 5.8 |
| F | 53.4 | 5.5 | 52.7 | 6.4 | 56.4 | 13.1 | 55.6 | 7.5 | 55.8 | 9.5 |
| K | 57.0 | 7.6 | 56.1 | 8.5 | 55.3 | 9.7 | 58.2 | 6.0 | 57.4 | 8.8 |
| Hypochondriasis | 54.7 | 7.8 | 52.3 | 6.6 | 55.5 | 10.5 | 55.3 | 9.2 | 55.8 | 6.1 |
| Depression | 54.5 | 8.9 | 55.5 | 13.0 | 61.8 | 10.3 | 52.0 | 10.8 | 55.1 | 12.8 |
| Hysteria | 58.7 | 6.3 | 58.4 | 7.1 | 58.9 | 11.9 | 59.1 | 5.4 | 59.3 | 6.7 |
| Psychopathic deviate | 56.4 | 7.9 | 56.4 | 7.9 | 61.2 | 12.1 | 62.3 | 5.8 | 59.9 | 9.7 |
| Masculinity-femininity | 64.5 | 9.9 | 62.4 | 7.4 | 67.3 | 8.0 | 65.9 | 5.4 | 65.2 | 8.6 |
| Paranoia | 55.4 | 7.9 | 56.2 | 7.9 | 60.7 | 11.3 | 59.3 | 7.8 | 62.3 | 9.7 |
| Psychasthenia | 57.5 | 7.7 | 59.6 | 10.6 | 63.9 | 9.3 | 59.7 | 8.0 | 64.3 | 15.7 |
| Schizophrenia | 59.7 | 7.5 | 60.1 | 9.4 | 64.9 | 13.6 | 62.1 | 10.5 | 63.3 | 14.6 |
| Hypomania | 59.3 | 10.5 | 58.6 | 9.7 | 52.5 | 13.3 | 63.7 | 11.1 | 58.1 | 10.8 |
| Social introversion | 50.3 | 8.5 | 49.4 | 10.4 | 58.3 | 12.0 | 42.9 | 6.9 | 50.4 | 8.9 |

**TABLE 3. Univariate Effect Sizes for Comparisons to Predict Combat Exposure and PTSD Symptoms From Premilitary MMPI Scores of Vietnam-Era and Vietnam Combat Veterans With and Without PTSD**

| | Effect Size (d) | | | |
|---|---|---|---|---|
| MMPI Scale | Combat Versus Noncombat | Any PTSD Symptoms Versus No PTSD | PTSD Diagnoses Versus Symptoms | Full Versus Subthreshold PTSD |
| Lie | 0.07 | 0.17 | 0.12 | 0.40 |
| F | 0.08 | 0.40 | –0.07 | 0.02 |
| K | –0.06 | 0.10 | 0.32 | –0.11 |
| Hypochondriasis | –0.15 | 0.42[a] | 0.00 | 0.07 |
| Depression | 0.12 | 0.06 | –0.73[a] | 0.27 |
| Hysteria | –0.01 | 0.09 | 0.03 | 0.04 |
| Psychopathic deviate | 0.23 | 0.57[b] | 0.02 | –0.35 |
| Masculinity-femininity | –0.05 | 0.47[a] | –0.23 | –0.10 |
| Paranoia | 0.30 | 0.50[a] | –0.02 | 0.36 |
| Psychasthenia | 0.32 | 0.26 | –0.20 | 0.39 |
| Schizophrenia | 0.17 | 0.30 | –0.19 | 0.10 |
| Hypomania | –0.08 | –0.03 | 0.71[a] | –0.51 |
| Social introversion | –0.05 | 0.08 | –1.08[b] | 0.89[a] |

[a] $p<0.05$.
[b] $p<0.01$.

dicted likelihood of any PTSD symptoms (odds ratio=3.54, 95% confidence interval=1.96–6.79).

Among the combat veterans with any lifetime PTSD symptoms, those with subthreshold or full diagnoses had lower scores in college on the depression (t=2.24, df=35, $p<0.05$) and social introversion (t=3.63, df=35, $p<0.01$) scales than did the veterans with symptoms only. Those with subthreshold or full diagnoses also had higher scores on the hypomania scale (t=2.16, df=35, $p<0.05$). The effect sizes (table 3) for these differences were large (13).

Only social introversion entered the logistic regression to predict a full or subthreshold PTSD diagnosis (odds ratio=0.27, 95% confidence interval=0.11–0.68). This model fit the data reasonably well (goodness-of-fit $\chi^2=35.9$, df=35, p=0.42). The accuracy was 78.4% (chance=64.5%), sensitivity was high (91.7%), and specificity was moderate (53.9%). By itself, combat exposure did not predict having a full or subthreshold diagnosis (odds ratio=1.14, 95% confidence interval=0.55–2.31) and had virtually no effect on the odds ratio for social introversion when we forced it into the model.

Table 3 shows that the combat veterans with full PTSD had scores almost a full standard deviation higher than did the subjects with subthreshold PTSD on the social introversion scale (t=2.34, df=22, $p<0.05$). However, even the full-PTSD group scored at the low end of the normal range, suggesting little introversion in either group.

Only social introversion entered the logistic regression to predict full lifetime PTSD (odds ratio=3.03, 95% confidence interval=1.01–9.14). The model fit was adequate (goodness-of-fit $\chi^2=22.4$, df=22, p=0.43), but the accuracy (62.5%) was only slightly better than the 58.3% expected by chance (sensitivity=60.0%, specificity=64.3%). There was a nearly significant trend for combat exposure by itself to predict decreased likelihood of a full diagnosis (odds ratio=0.43, 95% confidence interval=0.16–1.16, p=0.10); it had little effect on the odds ratio for social introversion.

## DISCUSSION

We found that premilitary MMPI scores predicted lifetime PTSD symptoms in Vietnam combat veterans. We examined predictors of diagnostic and subdiagnostic levels of PTSD and found similarities and differences among our three groups. Similarities were observed on the hypochondriasis, psychopathic deviate, masculinity-femininity, and paranoia scales. Combat veterans

with any lifetime PTSD symptoms had higher scores than did combatants who never developed PTSD. Differences were observed on the depression, hypomania, and social introversion scales. Lower depression and social introversion scores distinguished men with full or subthreshold lifetime PTSD from those with symptoms only. Higher social introversion scores also predicted a full versus subthreshold diagnosis.

In multivariate analysis, psychopathic deviate and masculinity-femininity scores were selected as the best predictors of any lifetime PTSD symptoms, and social introversion was selected as the best predictor of differences among the lifetime-PTSD groups. This does not mean that the unselected variables which were statistically significant in univariate analysis are unimportant but only that they do not distinguish between groups once the best predictors are considered.

Any interpretation of our results must acknowledge that these group mean scores on the MMPI do not suggest psychopathology, even though some individuals had high scores that were clinically significant. (For example, 11% of the men with lifetime PTSD symptoms had psychopathic deviate scores of 70 or higher.) If we base our interpretation on normal-range MMPI correlates in college men (14), we see an interesting picture in the multivariate findings. Normal-range scores on the psychopathic deviate scale are positively correlated with self-reports of gloominess, dissatisfaction, impulsivity, and irritability, and normal-range scores on the masculinity-femininity scale are positively correlated with inhibition, shyness, withdrawal, and conscientiousness. This suggests that men who are less happy and more withdrawn and inhibited than their peers may be at greater risk of developing lifetime PTSD symptoms if exposed to combat. However, the relationship of these characteristics to severity of subsequent symptoms may be complex. Social introversion scores in the normal range also are positively correlated with shyness, withdrawal, and inhibition (14), but low scores (less than 50) can be interpreted as indicating extroversion and problems of impulse control.

The mechanism by which premilitary personality is related to later PTSD is unlikely to be a greater tendency for individuals with certain personality styles to experience combat. The combatants and noncombatants did not differ in premilitary MMPI scores, and controlling for amount of exposure had little effect on estimates of personality variables. Still, amount of exposure was substantially related to greater likelihood of lifetime PTSD symptoms. This is consistent with previous findings (1–6) on the importance of combat exposure in the development of PTSD.

We are not the first to report subdiagnostic reactions to trauma. Weiss et al. (15) estimated that the lifetime prevalences of partial PTSD (comparable to our subthreshold PTSD; D. Weiss, personal communication, October 1991) in male and female Vietnam veterans are 22.5% and 21.2%, respectively. These figures, along with the similarities between our three lifetime-PTSD groups lead us to suggest the utility of considering subdiagnostic categories of PTSD or perhaps a wider range of reactions to traumatic stress in which PTSD is the most severe manifestation. Such steps might even identify factors that protect traumatized individuals from developing full-blown disorder.

Over the years, conceptualizations of combat-related psychiatric symptoms have ranged from emphasizing the trauma, as in shell shock, to emphasizing the person, as in combat neurosis. This study increases support for a multifactorial model of the etiology of PTSD by showing that pretrauma variables can predict reactions to a traumatic stressor such as combat even when characteristics of the trauma are taken into account.

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